

Claims

1. A method of filling a receiving cylinder with gas comprising:
 - 5 (a) flowing a first gas stream from a first dispensing cylinder to a receiving cylinder using a pressure differential between the cylinders;
 - (b) when the pressure differential between the first dispensing cylinder and the receiving cylinder has fallen to a selected value, stopping the flow of the first gas stream, then flowing a second gas stream from a second dispensing cylinder to the receiving cylinder using a pressure differential between the second dispensing cylinder and the receiving cylinder; and
 - 10 (c) when the pressure differential between the second dispensing cylinder and the receiving cylinder has fallen to a selected value, stopping the flow of the second gas stream, then increasing the pressure of a third gas stream from the first dispensing cylinder to a pressure greater than the pressure in the second dispensing cylinder, and then flowing the third gas stream into the second dispensing cylinder until the pressure in the second cylinder has increased to a selected value.
- 20 2. The method of claim 1 wherein the third gas stream pressure is increased by an intensifier.
- 25 3. The method of claim 2 wherein the intensifier is powered by one of a hydraulic pump, an air compressor and an electric motor.

4. The method of claim 2 further comprising before step (a), flowing a fourth gas stream from the first dispensing cylinder, through a driver of the intensifier then to the receiving cylinder using a pressure differential between the first dispensing cylinder and the receiving cylinder, and then flowing the third gas stream from the first dispensing cylinder through a compressor of the intensifier to increase the third gas stream pressure.

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10. The method of claim 1 wherein in step (b), the first gas stream flow is stopped when the pressures of the first dispensing cylinder and receiving cylinder have equalized.

15. The method of claim 1 wherein in step (c), the second gas stream flow is stopped when the pressures of the second dispensing cylinder and receiving cylinder have equalized.

7. A method of filling a receiving cylinder with gas using an intensifier having a compressor driven by a gas stream, the method comprising:

20 (a) flowing a first gas stream from a first dispensing cylinder, through the driver side of an intensifier and then to a receiving cylinder using a pressure differential between the cylinders;

(b) flowing a second gas stream from the first dispensing cylinder through a compressor of the intensifier such that the pressure of the second gas stream is increased above the pressure of a second dispensing cylinder, then flowing the second gas stream to the second dispensing cylinder;

25 (c) when the pressure differential between the receiving cylinder and the first dispensing cylinder has fallen

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to a first selected value, stopping the flow of the first and second gas streams, then flowing a third gas stream from the first dispensing cylinder to the receiving cylinder that bypasses the intensifier and uses a pressure differential between the first dispensing cylinder and the receiving cylinder; and

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(d) when the pressure differential between the receiving cylinder and the first dispensing cylinder has fallen to a second selected value, stopping the flow of the third gas stream, then flowing a fourth gas stream from the second dispensing cylinder to the receiving cylinder using a pressure differential between the second dispensing cylinder and the receiving cylinder.

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8. A gas dispensing system for filling a receiving cylinder with gas, the system comprising:

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(a) a receiving cylinder port fluidly connectable to a receiving cylinder;

(b) a first dispensing cylinder;

(c) a second dispensing cylinder;

(d) a gas pressure intensifier;

(e) a fluid flow circuit comprising fluid conduits fluidly coupling the first dispensing cylinder to the receiving cylinder port, the second dispensing cylinder to the receiving cylinder port, and the first dispensing cylinder to the second dispensing cylinder, and wherein the intensifier is fluidly coupled to the fluid flow circuit such that the pressure of a gas stream from the first cylinder can be increased above the

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pressure of the second cylinder thereby enabling the gas stream to be flowed from the first cylinder into the second cylinder; and

(f) gas flow valves fluidly coupled to the fluid flow circuit such that a gas stream can be controlled to flow from the first dispensing cylinder to the receiving cylinder port, from the second dispensing cylinder to the receiving cylinder port, and from the first dispensing cylinder through the intensifier and to the second dispensing cylinder.

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9. The system of claim 8 wherein the intensifier is powered by one of a hydraulic pump, an air compressor and an electric motor.

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10. The system of claim 8 wherein the intensifier comprises a compressor and a fluid driver that powers the compressor, and the fluid flow circuit further comprises a first fluid flow path from the first dispensing cylinder through the driver and to the receiving cylinder port, and a second fluid flow path from the first dispensing cylinder through the compressor and to the second dispensing cylinder, and the gas flow valves being configured to direct first and second gas streams through the first and second fluid flow paths such that the first gas stream powers the intensifier to increase the pressure of the second gas stream flowing therethrough.

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11. The system of claim 8 further comprising; a system controller in communication with said gas flow valves for actuating said gas flow valves in response to one of an external fill request signal and measurement of said cylinders and receiving cylinder conditions.

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